

# OCR A Level

Computer  
Science

H446 – Paper 1

2

## Types of Operating System

Unit 2

Systems software  
and applications  
generation



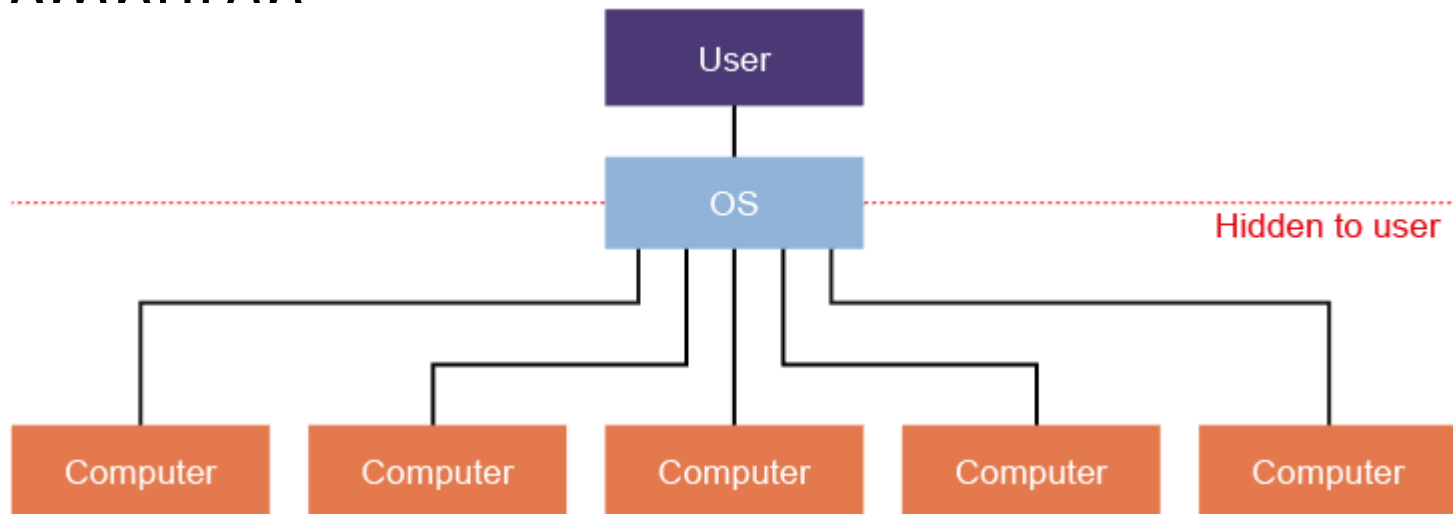
PG ONLINE

# Objectives

- Describe distributed, embedded, multi-tasking, multi-user and real-time operating systems
- Describe BIOS, device drivers and virtual machines

# Distributed Operating Systems

- We already know that the operating system manages communication with the hardware
- A distributed OS can coordinate the processing of a single job across multiple computers



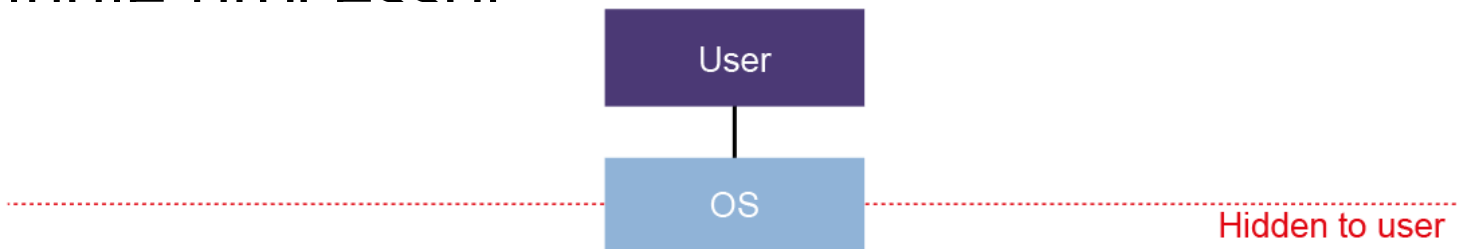


# Distributed Operating Systems

- A program can be run by the user that uses data or resources from any other computer
  - Resources could include processor time, memory and I/O facilities
- The distribution of tasks is coordinated by the OS passing instructions between computers

# Distributed Operating Systems

- The user can access more computational power with the illusion of working with a single processor



- No need for training or writing programs differently

**BUT**

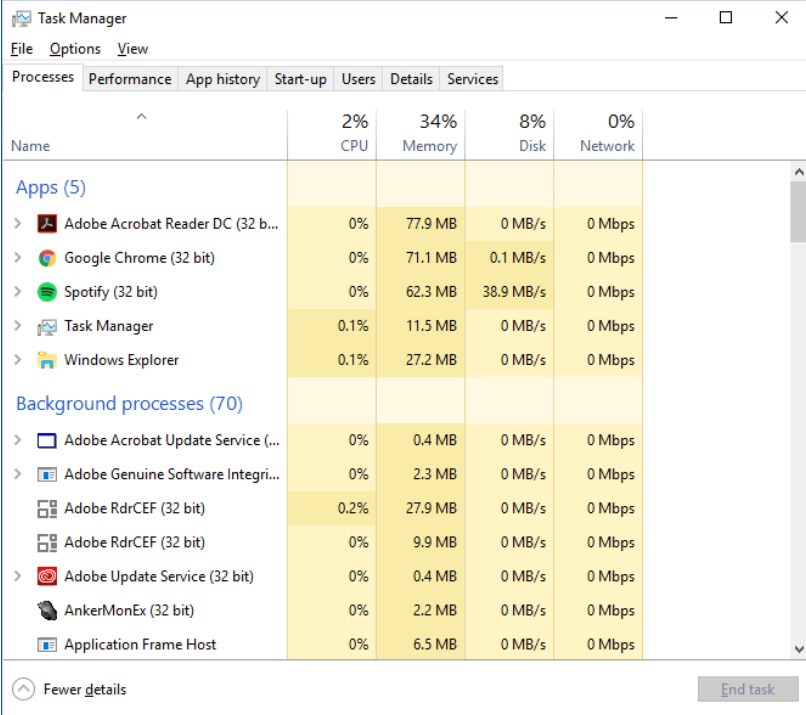
- The programmer has no control over the task distribution as this is entirely handled by the OS

# Multi-tasking system

- A single processor can appear to do more than one task simultaneously by **scheduling** processor time

Reading a document, browsing the web and listening to music at the same time

Other processes are also running in the background

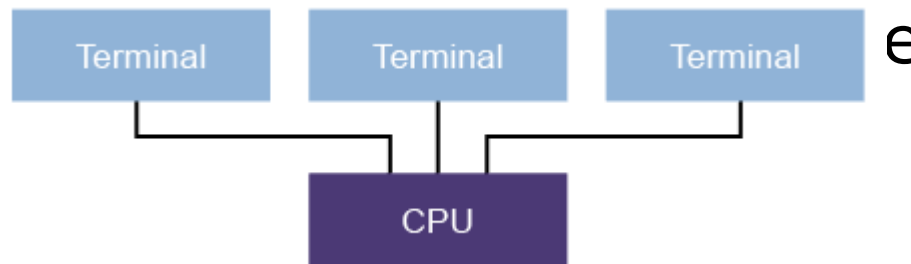


The screenshot shows the Windows Task Manager window with the 'Performance' tab selected. It displays a table of system resources and running processes. The top section shows overall usage: 2% CPU, 34% Memory, 8% Disk, and 0% Network. Below this, there are two sections: 'Apps (5)' and 'Background processes (70)'. The 'Apps' section lists Adobe Acrobat Reader DC, Google Chrome, Spotify, Task Manager, and Windows Explorer. The 'Background processes' section lists various Adobe services, Adobe ReaderCEF instances, AnkerMonEx, and Application Frame Host. Each process row shows its name, CPU usage, memory usage, disk usage, and network usage.

Name	2% CPU	34% Memory	8% Disk	0% Network
<b>Apps (5)</b>				
Adobe Acrobat Reader DC (32 b...	0%	77.9 MB	0 MB/s	0 Mbps
Google Chrome (32 bit)	0%	71.1 MB	0.1 MB/s	0 Mbps
Spotify (32 bit)	0%	62.3 MB	38.9 MB/s	0 Mbps
Task Manager	0.1%	11.5 MB	0 MB/s	0 Mbps
Windows Explorer	0.1%	27.2 MB	0 MB/s	0 Mbps
<b>Background processes (70)</b>				
Adobe Acrobat Update Service (...)	0%	0.4 MB	0 MB/s	0 Mbps
Adobe Genuine Software Integri...	0%	2.3 MB	0 MB/s	0 Mbps
Adobe RdrCEF (32 bit)	0.2%	27.9 MB	0 MB/s	0 Mbps
Adobe RdrCEF (32 bit)	0%	9.9 MB	0 MB/s	0 Mbps
Adobe Update Service (32 bit)	0%	0.4 MB	0 MB/s	0 Mbps
AnkerMonEx (32 bit)	0%	2.2 MB	0 MB/s	0 Mbps
Application Frame Host	0%	6.5 MB	0 MB/s	0 Mbps

# Multi-user, multi-tasking system

- Some systems use a very powerful computer called a mainframe
  - These might be seen in universities or large businesses
- Lots of users with their own terminals access the mainframe's CPU and each gets a time slice
- Each term processes



# Mobile Operating Systems

- A smart phone is a computer with a multi-tasking Operating System
  - The iOS operating system on an iPhone for example, can run notes, calculator, to-do and phone apps at the same time





# Mobile Operating Systems

- Mobile operating systems are linked to specific hardware
  - e.g. Android phones have different hardware to iOS phones
- A low level proprietary OS is used for handling the hardware and special features
  - Features include cellular connectivity and wi-fi
- Meanwhile, the main OS handles the user interface and running applications

# Open source operating system

- **Android** is an open source OS based on Linux and owned by Google
- It is used by all major device manufacturers including Samsung, Motorola, Dell, Ericsson
- It allows for major customisation
- A device manufacturer can fine-tune the OS to suit their devices, and add additional features or user interfaces to enhance the user experience
- The interface and the available apps can be a major selling point

# Worksheet 2

- Complete **Task 1** on the worksheet



# Embedded Operating Systems

- Many devices in your home have an OS and run simple programs
  - How many examples can you think of?





# Household devices

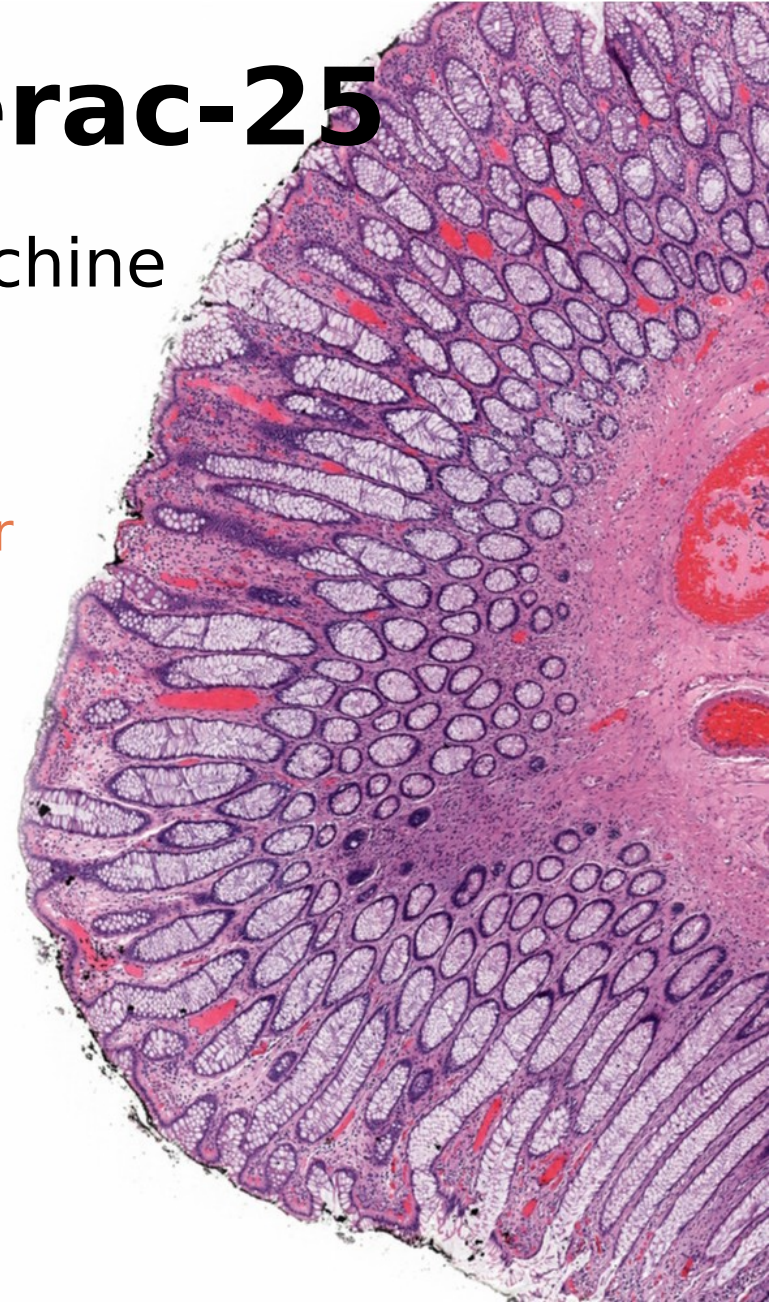
- The embedded OS has minimal features
- Application programs are held in ROM
- There is a limited amount of RAM
- The user interface is simple and minimal
  - What do you think the inputs and outputs would be for a household appliance?

# Real time Operating Systems

- Some operating systems must operate in real time
  - Must respond extremely quickly to inputs
  - May need to cope with many inputs simultaneously
- Real time Operating Systems are usually seen in **safety-critical** environments
- If a hardware component fails, the OS must have a **failsafe** to detect this and respond appropriately
- There is hardware **redundancy** - crucial components are duplicated in case one fails

# Case study - Therac-25

- 1980s radiation therapy machine with a **real time** embedded operating system
  - Patients were treated for cancer through exposure to targeted beams of radiation
  - Programming errors meant the machine responded incorrectly to certain real time inputs
  - Several people died as a result of accidentally being hit by massive radiation overdoses



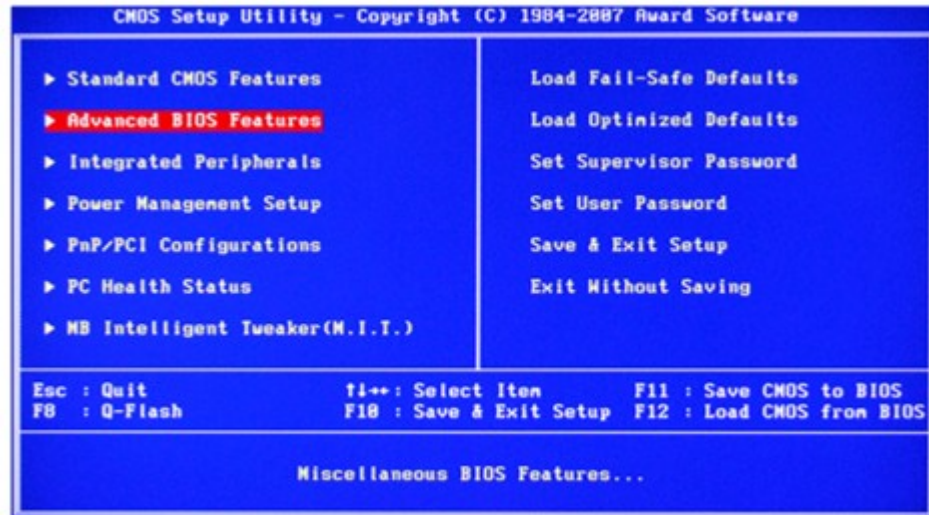
# Worksheet

- Complete **Task 2** on **Worksheet 2**



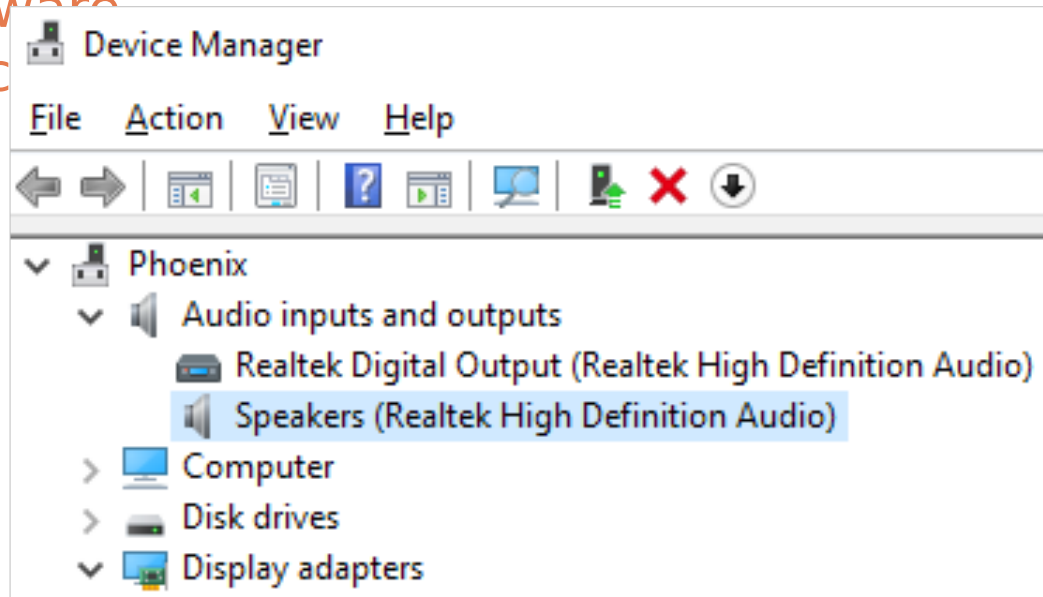
# BIOS

- BIOS (Basic Input Output System) is stored in ROM
- The BIOS boots the computer at start-up
  - Initialises and tests hardware
  - Loads the operating system



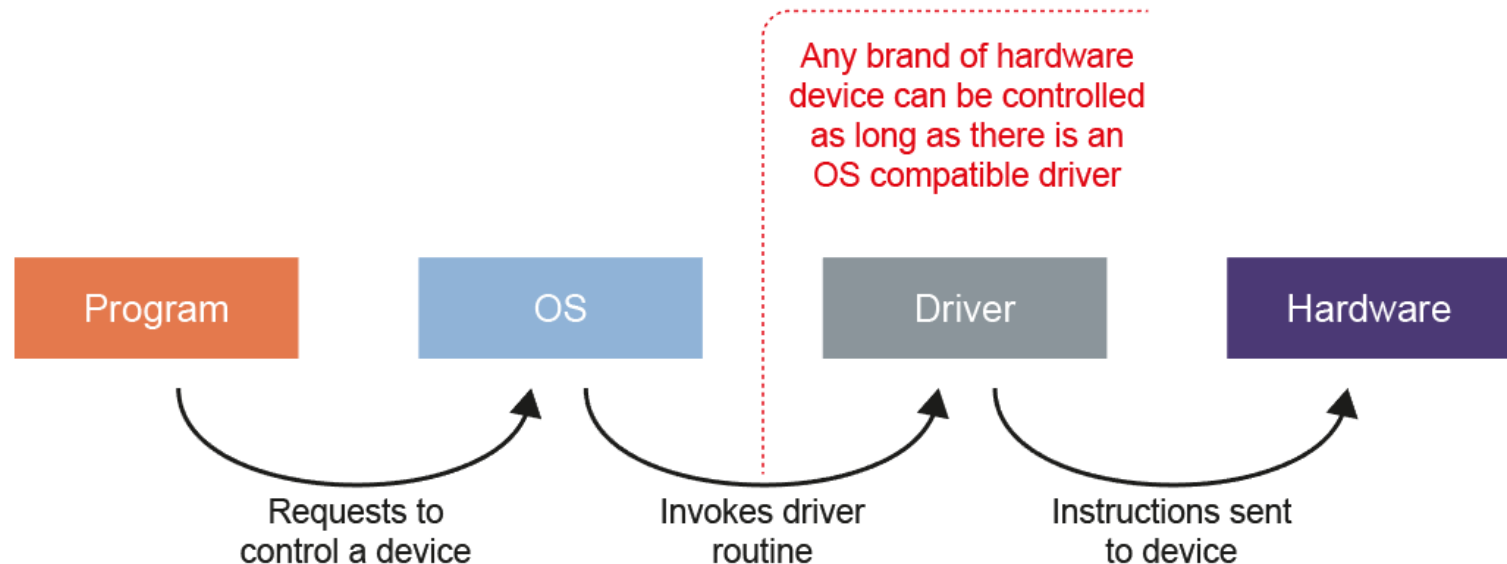
# Device drivers

- A driver is a program that provides an interface for the OS to interact with a device
- Drivers are hardware dependent and OS specific
- Drivers are needed to allow the OS to control hardware devices



# Device drivers

- The OS does not need to know the specifics of the hardware to be able to interact with it



# Virtual Machine

- Software is used to emulate a machine
- Can be used for running one OS inside another to emulate different hardware
- A virtual machine can execute intermediate code e.g. Java virtual machine executes Java byte code
  - The MAME virtual machine can emulate the hardware of old arcade machines so that their games can be played on a modern PC





# Plenary

- Operating systems can be
  - Distributed across multiple computers
  - Embedded into systems such as home appliances
  - Multi-tasking, for doing several things at once
  - Multi-user, to allow a mainframe's CPU to be shared
  - Real-time, to respond quickly when safety is critical
- The BIOS loads the operating system at boot time
- Device drivers allow the OS to control hardware
- Virtual machines are software emulating



### Copyright

© 2016 PG Online Limited

The contents of this unit are protected by copyright.

This unit and all the worksheets, PowerPoint presentations, teaching guides and other associated files distributed with it are supplied to you by PG Online Limited under licence and may be used and copied by you only in accordance with the terms of the licence. Except as expressly permitted by the licence, no part of the materials distributed with this unit may be used, reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic or otherwise, without the prior written permission of PG Online Limited.

### Licence agreement

This is a legal agreement between you, the end user, and PG Online Limited. This unit and all the worksheets, PowerPoint presentations, teaching guides and other associated files distributed with it is licensed, not sold, to you by PG Online Limited for use under the terms of the licence.

The materials distributed with this unit may be freely copied and used by members of a single institution on a single site only. You are not permitted to share in any way any of the materials or part of the materials with any third party, including users on another site or individuals who are members of a separate institution. You acknowledge that the materials must remain with you, the licencing institution, and no part of the materials may be transferred to another institution. You also agree not to procure, authorise, encourage, facilitate or enable any third party to reproduce these materials in whole or in part without the prior permission of PG Online Limited.